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ABSTRACT

The Science Activities Action Research Group considered problems related to using science activities in teaching/learning of science ideas, problems previously identified and described during exploratory/in-depth phases of the Learning in Science Project. Three specific tasks were formulated by the group, including: investigating wording of instructions in science activities in an attempt to enhance the likelihood that children would do what is expected; looking at the planning involved in a science activity to see if the impact and effectiveness of the activity could be improved; and considering ways of highlighting/assessing aspects of science activity work often overlooked or ignored (for example, expected skill level of students). Materials produced by the group were organized into three units: the first presented problems identified by the Learning in Science Project and provided teachers with activities to help them see the problems in their own context; the second stated problems action-research members had sought to respond to and described the nature of those responses and their impact on learners/teachers; and the third explored the role of science activities in science teaching/learning and attempted to relate science activities to a range of teaching approaches. Checklists were also developed for planning/evaluating science activities and for student evaluation of science activities. (JN)

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LEARNING IN SCIENCE PROJECT

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TOWARD SOLUTIONS:

The work of the

Activities Action - Research Group

University of Waikato
Hamilton, N.Z.

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WORKING PAPER 46

Working Paper No. 46 is the first in a series of papers on Science Activities. Others in the series are:

Working Paper No. 47	-	Science Activities: The Problem
Working Paper No. 48	-	Science Activities: Specific Problems - some solutions
Working Paper No. 49	-	Science Activities: wider considerations

THE WORK OF THE ACTIVITIES ACTION-RESEARCH GROUP

John Lambert and Ross Tasker

December 1981

INTRODUCTION

The Science Activities Action Research Group (S.A.G.) considered problems related to the use of science activities in teaching and learning of science ideas, problems which had earlier been identified and described in working papers of the exploratory and in-depth phases of the Learning in Science Project.[1]

The personnel to make up the group were chosen to provide a variety of experience in, and perspectives of, the use of science activities in teaching as well as a range of academic backgrounds in science. It consisted of practising classroom teachers and Learning in Science Project team members. (See Appendix 1).

Prior to the first meeting in March, 1981, individuals were sent the working papers of the in-depth phase - Focus on Experiments and Focus on Process Skills and asked to consider whether the problems and difficulties described in these papers related to real, important, and possibly solvable issues.

THE MEETINGS OF THE GROUP (March 10, 1981)

The First Meeting

The group agreed that the problems identified and described by the papers appeared real and were wide spread. No attempt was made at this time to direct discussion other than to the points of the papers being considered. As a consequence, reaction to the problems described was diverse and reflected the differences in teaching approach represented in the group. Not surprisingly there was a wide range of opinion as to

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1. Working papers - Focus on Experiments (No.2) Focus on Process Skills (No.7) Visits to a classroom No.1 to No.4 (Nos.13, 39, 40, 41) and Children's Views and Classroom Experiences (No.43).

how the problems might be resolved. However, general agreement was reached that the group should aim to produce material for in-service training work with teachers that attempted to deal with the problems described in the papers. To that end members of the group agreed to undertake specific tasks and report on them at the second meeting. These tasks were:

i. To investigate the wording of instructions in science activities in an attempt to enhance the likelihood that children will do what is expected.

ii. To look at the planning involved in a science activity to see if the impact and effectiveness of the activity can be improved.

iii. To consider ways of highlighting and assessing aspects of science activity work often overlooked or ignored e.g. expected skill level of pupils.

The Second Meeting (April 28, 1981)

The responses to the working briefs accepted at the first meeting reflected the diversity of views apparent in that meeting. Some of the material was presented in considerable detail but the convenors of the group were confronted with a difficulty in that the specific problems outlined in the working papers, mentioned earlier, had not been dealt with. The problem essentially was to direct the enthusiasm of individuals and the group to deal with the specific problems of the working papers and yet use the material already produced which represented a great deal of thought, hard work and experiences.

The Third Meeting (July 29, 1981)

Prior to the third meeting, JL and RT spend some time considering ways and means of dealing with the problem outlined above. It was decided that RT would spend some time outlining the LISP project team members view of science activity concerns. The discussion point outline (see Table 1) proved to be a very provocative, and a good deal of animated discussion ensued.

TABLE 1 Crisis points in a science activity +

The teacher's proposed problem for pupils to investigate	needs to become →	The pupil's own problem
The teacher's proposed activity for pupils to carry out	needs to become →	The pupil's own activity
The teachers solution of the problem	needs to be related to →	The pupil's solution

+ An activity where a scientific problem has to be solved

RT also produced a table (TABLE 2) which allowed members of the group to focus on specific issues..

As a result of this discussion more specific working briefs were accepted by some members.

TABLE 2 : Problems that can occur in science lessons

	Some possible mismatches between teacher and pupil preceptions. It would be extremely rare for all these to occur in any one lesson		Some consequences of the mismatch (if it does occur).
Relating to setting the scene of the lesson	Teacher's Viewpoint	Pupil's Viewpoint	
a. Scientific context of the lesson/activity	The lesson/activity is seen as part of a related series of experiences	The lesson/activity is seen as an isolated event.	Pupils do not consider the lesson/activity against important prior experiences.
b. Scientific purpose of the lesson/activity	The scientific purpose of the lesson/activity is specific and obvious.	The purpose of the lesson/activity is not obvious.	Pupils guess at and invent what seems to them to be a reasonable purpose.
c. Scientific design of the investigatory activity	The activity has certain critical scientific features which enable particular ideas to be tested.	The critical scientific features of the activity are not recognised or understood.	Pupils are unaware of which aspects of the activity need particular attention and why.
Relating to pupils			
a. Doing the activity	What the pupils are to do is obvious and requires skills the pupils possess.	What to do is not understood and the skills needed are not available.	Pupils do things which they think appropriate to reach the end of the activity.
b. Getting results	Pupils know what to look for and will recognise the result of the activity.	What to look for and how important a result is, is not clear.	Pupils focus on, and observe, unexpected aspects of the activity. They are preoccupied with "What is supposed to happen?"
c. Thinking about what was done and what happened	Pupils will consider critically their actions and findings.	There is no awareness that actions and findings should be critically examined.	Pupils see the activity as 'getting the right answer' or guessing what the teacher wanted from the activity.
Relating to outcomes achieved			
a. Evaluation of the experience	Pupils will consider the experience against the ideas and perceptions of scientists' science.	The experience if considered against ideas and perceptions of childrens' science.	Pupils have difficulty relating what they did and saw happening to their thinking.
b. Significance of the experience	There are pre-determined outcomes which are significant for achieving the teachers aim.	The significant outcomes are not detected or detectable because they do not relate to the personal view held.	Pupils develop negative attitudes to school science as being not relevant.

The Fourth Meeting (September 22, 1981)

At this meeting it was evident that a good deal of in-class work had been completed by members of the group. This work had two aspects:

i. Work that had been initiated by group members in response to the discussion in meeting three. This work involved language investigation, teacher strategies and further work with teacher and pupil aimed survey material.

ii. RT developed a science survey with evaluation notes based on a science experiment taken from a widely used textbook. Members of the group had worked this activity with a range of classes obtaining 'in context' feedback of the problem points outlined in RT table (Diagram 2).

The Fifth Meeting (November 11, 1981)

This session was a finishing off session; the main point of concern being the way that material with broad terms of reference could be developed into a useful package. The decision arrived at was that the material would be organised into three units. The units to be as follows:

Working Paper No. 47 Science Activities : The Problem

This unit would set out the problems as identified by LISP and provide teachers with activities which would help them see the problems in their own context.

Working Paper No. 48 Science Activities : Specific Problems - Some Solutions

This unit would state those problems the action-research members had sought to respond to, describe the nature of those responses and their impact on the learner and teacher.

Working Paper No. 49 - Science Activities - Wider Considerations

This unit would explore the role of science activities in the teaching and learning of science and attempt to relate science activities to a range of teaching approaches.

THE WORK OF THE GROUP

1. The Planning of Science Activities

A number of members of the group worked in this area of concern (J.G., B.W., J.L., G.D and D.W.). The original contentions were:

(a) That teachers are often so concerned about the equipment and material problems associated with activity work that they give little thought to the activity itself. Why the activity is part of the programme and what they hope the pupils to achieve in the course of the activity are not considered.

(b) That teachers have a very narrow view of what constitutes a science activity - that is a view restricted to practical work in a laboratory.

In one avenue of research a series of checklists for use with science activities were developed, trialled and modified a number of times in the course of the year. These were trialled in the schools of the developers as well as at in-service day courses in the region.

In their final form these checklists became:

1. An index card for Planning Science Activities
2. A checklist for Planning Science Activities
3. A checklist to Evaluate a Science Activity
4. A checklist for Pupil Evaluation of a Science Activity

The other main research avenue involved broader planning issues. Here work involved the drawing together of ideas gained from the personal experience of group members in setting up programmes of work from scratch, and the findings of the Learning in Science Project. This work was to provide the material for Working Paper 49, Science Activities - wider considerations.

2. Teaching Strategies and Science Activities

A number of enquiries centred on the language used in the instructions to science activities were carried out by group members (C.J. and B.W.). Work was carried out on

- problems caused by instructional words
- problems caused by the form of instructions
- the use of focus questions in the instructional material
- exercises in scrambling and unscrambling instructions
- the use of support diagrams
- the use of centre of interest techniques

Some of these enquiries were completed to a stage where they could usefully be written up, in Working Paper 48.

A number of enquiries (R.T., J.P., B.W., C.J.) focused on the form of assistance which can be made available to pupils with specific learning difficulties related to science activities. The use of survey material to identify pupils with these problems provoked much interest and continued work in this area is anticipated. The influence of such surveys in deciding the appropriateness of an activity, as carried out in a lesson, is potentially a very useful teaching device.

3. Assessment and Science Activities

The development and use of checklist and profile recording/reporting techniques for those aspects of activity work which teachers acknowledge as being important, but ignore in their assessment procedures was the concern of one group member (L.W.). This area of concern needs some intensive work especially in the area of:

1. How specific skills can be tested.
2. Establishing skill and attitude inventories for individual pupils.
3. Profile recording and reporting.

CONCLUDING COMMENT

The co-ordinators of the group (RT, JL) were concerned to obtain an original response to the Learning in Science Project findings related to Science Activities.

Consequently at the initial meeting there was no direction given to members as to the way they might respond through their teaching to the findings. However, it was hoped that a number of specific problems associated with Science activities had been recognised and accepted. This was not the case, for at the second meeting when initial responses to the finding were tabled a number of unexpected perspectives were apparent.

Looking back on the material and discussion of meeting one, two possible reasons for this position seem likely. (i) The L.I.S.P. papers focusing on Process Skills and Experiments did not spell out the specific problems in science activities in a way that teachers immediately recognised and/or (ii) While a general problem in science activities was accepted, the specific problems identified by L.I.S.P. were not.

This issue was clarified by the co-ordinators, prior to meeting 3, involving group members with an evaluation survey based on a science activity, and introducing further L.I.S.P. material in meeting 3 - from Working Paper 43 - Children's Views and Classroom Experiences (see Table 2).

The above strategies enabled the co-ordinators to refocus the developments that individuals had initiated without dampening what was obviously a real desire to enhance science activities as a teaching and learning vehicle.

The stronger direction given by the co-ordinators at meeting 3 did bring about a closer link between the L.I.S.P. work and the action research.

The above redirection was not achieved without considerable debate. Some group members were concerned that they were being asked to abandon a philosophy of teaching science which had been formed from considerable experience and thinking. This debate forced everyone concerned to think carefully through the significance of the L.I.S.P. findings in terms of their own teaching. By the time Working Paper 49 had been drafted a common position based on the view that successful science teaching required active teaching using a variety of approaches was reached.

Although at times this debate appeared to cloud what the co-ordinators saw as the issues of central concern, in retrospect the debate was undoubtedly the thing which clarified the L.I.S.P. philosophy for the members of this group.

APPENDIX 1

The Science Activities group comprised:

Grant Duane	-	Western Heights High School
Tony Friedlander	-	Putaruru High Shool
John Grant	-	Tokoroa High School
Colin Jackson	-	Tauponui-a-Tia College
John Lambert	-	Tokoroa High School
John Provo	-	Tongariro College
Brendan Schollum	-	Learning in Science Project
Ross Tasker	-	Learning in Science Project
Leigh Webber	-	Kawerau College
Dave Whaley	-	Rotorua Boys High School
Tim Willetts	-	Tokoroa High School
Brian Woolhouse	-	Tokoroa High School